

## GENERAL PRACTICE

## Strabismus in General Practice

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## ABSTRACT

Considerable confusion exists concerning the time at which a cross-eyed child should be referred to an ophthalmologist. This referral should be made between six and nine months because visual and muscular co-ordinated reflexes necessary for normal vision and stereopsis develop at six months, and 80% of these reflexes are established by the age of two. Normal anatomical relations must be established shortly after six months to avoid the formation of fixed, irreversible, abnormal reflexes which lead to loss of vision in one eye and lack of stereopsis.

The recommended classification of crossed eyes emphasizes the insidious divergent type that must be treated in infancy.

Reasons for delay in referring cross-eyed children include incorrect advice from the family doctor and inappropriate advice from optometrists. Treatment is aimed at the development of normal vision in each eye, stereopsis, and a good cosmetic result.

## RESUME

Beaucoup de confusion existe quant au meilleur temps pour diriger vers l'ophtalmologiste l'enfant qui souffre de strabisme. L'âge idéal paraît être entre six et neuf mois; les réflexes coordonnés visuels et musculaires amenant une vision normale et stéréoscopique se développent à six mois, et à l'âge de deux ans ces réflexes sont déjà établis dans une proportion de 80%. Il est donc important que les relations anatomiques soient normales après six mois si on veut éviter la formation de réflexes anormaux fixes et irréversibles qui conduisent à l'amblyopie et conséquemment à l'absence de vision stéréoscopique.

La classification du strabisme est passée en revue en insistant sur le type de strabisme divergent de nature insidieuse qui doit être traité très jeune.

Parmi les raisons qui retardent la venue de l'enfant chez l'ophtalmologiste, il y a les conseils du médecin de famille non averti ou les conseils incompetents d'optométristes. Le traitement consiste à développer une vision normale dans chaque œil, et une vision stéréoscopique en plus de donner un bon résultat esthétique.

**T**HE modern ophthalmologist welcomes the opportunity to examine all cases of strabismus (crossed eyes) whether they are actual or suspected, convergent or divergent, occasional or constant, at between the ages of six and nine months. Unfortunately, a large number of children with strabismus are not being examined by ophthalmologists until the age of four years or older.

## THE PATHOPHYSIOLOGY OF STRABISMUS

The scientific reasons behind the ophthalmologist's desire to see the child with strabismus at six to nine months of age are as follows:

At the age of six weeks the conjugate fixation reflex (three-dimensional vision mechanism) becomes established; by the age of six months the conjugate deviations (convergent and divergent range of three-dimensional vision) become fully accurate and the maculae (central vision areas of the retinae which see fine detail) are developed. At this very important time in life, these developments are all in a plastic stage and can be influ-

enced towards an improper balance if the anatomical relations are incorrect, or towards stronger, more fixed, and accurate relations if the anatomical factors are normal. By the age of five all of these reflexes are fixed for life.

For every month that treatment is delayed after the age of one year, the percentage chances of developing normal ocular reflexes diminish. As long as these ocular reflexes remain abnormal, binocular (three-dimensional or stereoscopic) vision will not develop; and as long as there is no binocular vision, only one eye at a time will be employed. Occasionally, alternate use of the eyes develops, and in these individuals normal vision may be attained in each eye separately, but without any stereoscopic vision. However, in the vast majority of cases, the eye with which it is easier to see is employed entirely, while the other eye stops developing and becomes, to all intents and purposes, practically useless or, to speak technically, amblyopic. Success in the treatment of amblyopia diminishes progressively from the age of six

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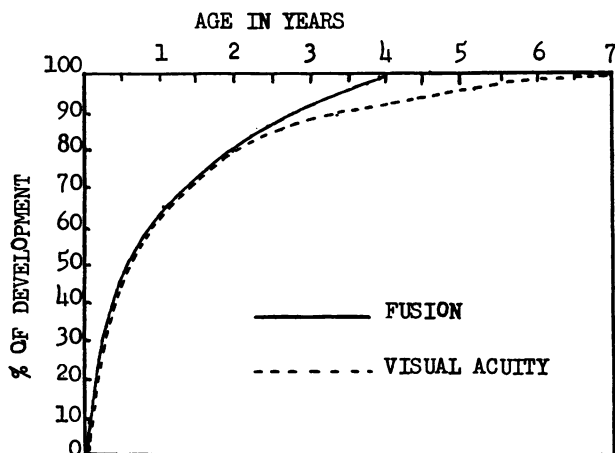


Fig. 1.—Graph of the development of visual acuity and of stereoscopic vision (binocular vision, fusion) in the first seven years of life.

months to five years, at which point no further improvement can be expected. Unfortunately, the graph of the development of vision (Fig. 1) is not a straight line but a rapidly rising curve in the first two years of life, leaving a much smaller percentage of development potential in the third, fourth and fifth years. Likewise, the chance for successful stereoscopic vision is much greater if the opportunity to develop is provided in the first two years of life, than if it is provided in the following three.

There are, of course, other reasons for turning eyes besides lack of normal reflex development. Anything that blocks the line of vision in an eye usually will cause that eye to turn out of line with its fellow; thus intraocular disease, tumour such as retinoblastoma, cataract, retrolental fibroplasia, unocular glaucoma, microphthalmus, or any one of many other congenital abnormalities may block the line of vision. If this obstruction to vision in one eye occurs in the first two years of life, this eye will usually converge; if it occurs later than the age of two, it will more frequently diverge. Hence, on a purely medical basis, no crossing eye should be neglected nor should procrastination be allowed in securing an ophthalmological examination.

#### CLASSIFICATION OF STRABISMUS

Eyes may cross in any direction: in, out, up, down, diagonally, or they may even wheel-rotate. The three most common types are:

1. *Esotropia* (convergent strabismus, turned-in eyes). This defect is frequently associated with hypermetropia (so-called far-sightedness) in which the focus point of the eyes is beyond the horizon. In this condition, continuous focusing of the eyes is required in order to see infinity. Unfortunately, the brain sends out a converging order to the eyes in ratio to the degree of focusing required. In the normal eye, focusing only occurs as the viewed object approaches, so that convergence of the eyes enables stereoscopic vision to be maintained. If

over-convergence takes place, as is frequent in excesses of hypermetropia, diplopia (double vision) will occur and strabismus, suppression and amblyopia will follow, as explained above. Many of these defects, if discovered and treated early before this sequence of events takes place and before permanent compensatory changes occur in the extraocular muscles, may be cured by prescribing glasses. Others, following occlusion to equalize visual acuity, require extraocular muscle surgery. Many parents are afraid of eye surgery, but when it is explained to them that this is not actually an eye operation at all, but merely a simple rearrangement of the muscles that are completely outside of the eyeball, and that there is no danger to the vision of the eye, they usually feel quite differently. Some people also have the idea that the ophthalmic surgeon removes the eyes from the head and puts them back again; once this old wives' tale is exploded, these people also become amenable.

2. *Exotropia* (divergent strabismus, turned-out eyes). This is a much more insidious problem. In the early stages, the defect shows up only when the child is not concentrating and is looking off dreamily into the distance; this usually occurs between the ages of six months and one year. These children usually have little, if any, refractive error, but some may be myopic (short-sighted) or hypermetropic (far-sighted). If these children receive no treatment when divergence first begins, the condition apparently improves for a period of from one to two years; actually, partial field-of-vision suppression goes on during this period and is usually followed by an obvious increase in divergence. At this stage the child is usually between four and six years of age, and the ophthalmologist is faced with a much more complicated treatment problem and can only obtain a lower percentage of good postoperative results. Surgery on these cases is imperative if the turning-out tendency is 10 degrees or more when looking at infinity, even if apparent recovery occurs when the child is focusing at the reading distance.

3. *Hypertropia* (one eye looking higher up than the other). This is much less common and involves a more complex treatment regimen which frequently requires more than one operation. If untreated, suppression, amblyopia and loss of stereoscopic vision occur as above.

#### REASONS FOR DELAY IN REFERRAL TO THE OPHTHALMOLOGIST

1. The parents may have been told by their family doctor, when the condition was first noticed at the age of six months or more, to wait until just before the child goes to school. While it is easy for the ophthalmologist to be critical when his confrères outside the specialty do not keep up to date with the many recent changes in eye work, much of the blame should be laid at the door of the ophthalm-

ologist. It is his duty to keep his colleagues informed by word of mouth and, in the limited reading time at their disposal, through the media of the general medical journals. The general practitioner in this day and age is being swamped with new material in every field of medicine, and it is becoming more and more difficult for him to keep up to date on everything.

2. The parents may have been advised by relatives or friends to wait and see if it would get better on its own and that, in any case, if it didn't, it could always be fixed later. Grandparents are most frequently to blame for this advice, as many of them have a dominant influence over the parents; in many cases our effective level of public education in medical matters is that attained by the older generation.

3. The parents may have concluded that treatment at an early age might be dangerous or impossible; or they may have found themselves unable to face the idea of glasses or surgery for such a "little child".

4. They may have been to an optometrist who, being legally forbidden to use drops, was unable to gain an accurate idea of the child's refractive error and who, all too often, may be unwilling to lose the "business" by sending the child to an eye doctor. The parents may even have gained the impression that the optometrist was medically trained and, when he did not advise surgery, assumed that this was a medical opinion. The fact that many optometrists use the prefix "doctor" even though they have never been to medical school, and that this loose usage of the term is ignored or condoned by both government and judiciary, further adds to the parental confusion. The letters O.D. placed after the optometrist's name stand for Diploma in Optometry, not Doctor of Optometry.

5. In children with strabismus in whom there is a small angle of turn (e.g. less than  $10^\circ$ ), parents are frequently so accustomed to the child's appearance that they fail to realize that the child's eye is crossed. Friends and neighbours often are too embarrassed to point the defect out to them or, if they do, are all too often met with frigid denial of the possibility, because many families think of strabismus as a family taint on a par with insanity.

6. For religious reasons or false pride, some parents deny their cross-eyed children professional care by a medically trained oculist until the child forces the issue at puberty or reaches the age of 21 and seeks it without parental consent.

7. Many infants and young children have a wide, flat nose base, and the skin in these cases may cover much of the white sclera to the medial side of each cornea (epicanthal folds). This gives the appearance of a pseudoconvergent strabismus; because it is a well-known entity, many general practitioners and pediatricians tend to ignore it without checking to see if both epicanthal folds and strabismus may not be present simultaneously. The author has seen six such cases in the past year.

## TREATMENT

The ophthalmologist has three basic goals in the treatment of strabismus:

1. *The development of normal vision in each eye.*—Normal visual acuity of 20/20 is usually obtained easily, sometimes with the aid of glasses, in the straight eye; however, development of vision in the suppressed (amblyopic) eye must be obtained by forcing the child to use the affected eye. This is done by applying occlusion to the straight eye, a process which can sometimes be much more complicated than previous knowledge suggested. Sometimes a child, in an effort to maintain binocular vision, will combine an off-macular area of the retina in the turning eye with the macula of the straight eye; under these circumstances the application of occlusion to the straight eye to build up the vision of the turning eye will meet with little success because the potential of the off-macular area for vision will be subnormal at the best. A new instrument, the Visuscope, allows the ophthalmologist to determine what area of the retina is being used for central vision, and if an off-macula area is in use, a much more complicated approach (pleoptics) is required. If suppression began in the first year of life and the attempt at development of vision in the suppressed eye was not begun until the third or fourth year of life, the depth of amblyopia may be insurmountable. Furthermore, if a gross refractive error is present which makes it impossible for the child to see well without glasses, regardless of effort, the brain is not presented with a clear picture and never learns to appreciate fine detail. If such a child receives corrective glasses for the first time after the age of five, it is too late for the brain to learn to appreciate the clear image, and glasses seldom increase the visual acuity to any extent. Hence the importance of examining all children under the age of nine months if there is a family history of gross refractive error, entirely apart from strabismus.

If amblyopia persists, vision in the affected eye cannot be developed in later life. This child is faced with the life-long hazard of having only one good eye and, should this be lost, of being reduced to semi-blindness. Furthermore, his employability is seriously reduced.

2. *The development of stereoscopic vision* (synonyms: binocular vision, or fusion). This depends on both eyes seeing the same object simultaneously. If the eyes are parallel, and otherwise normal, this development occurs automatically; however, if the eyes are not parallel, double vision (seeing two dissimilar objects simultaneously) results. Double vision causes confusion, and the brain deals with it by suppressing the image of one eye. The vision area of the brain which is suppressed ceases to develop beyond that state of development already reached, and regression (which is subject to recovery with occlusion later) will further reduce the acuity of the turned eye to the point where it

may become almost useless. The age at which suppression of vision begins is all-important and determines, along with the age of starting treatment, the ultimate vision of the turned eye. Unless, using the Snellen chart, the vision in the turned eye can be developed to within one line of that of the straight eye, stereoscopic vision is unlikely to develop.

Older literature has always assumed that many cross-eyed patients are born with insufficient fusion potential and, that despite all efforts, their fusion will remain poor or non-existent. This may very well be true, but with the initiation of early treatment including surgery as early as six to eight months of age, the percentage of "non-fusers" has been grossly reduced. In this respect Leahey<sup>1</sup> stated: "The failures were due mainly to the fact that operation was not performed early enough. The concept of immediate surgical correction entails re-education of both the public and the medical profession so that new cases . . . will obtain speedy ophthalmologic care as a semi-emergency condition."

Lack of stereoscopic vision also reduces employability. Because insurance rates on employees having no depth perception are about 17% higher, many large companies refuse to employ them.

Eye co-ordination exercises (orthoptics) are frequently of value immediately before operation to make the brain "fusion-conscious" and, immediately after surgery, to stimulate and help the development and consolidation of fusion. Other than under these circumstances, orthoptic exercises are of no value, hold no promise of curing a crossed eye, and, if employed in a patient with established alternating suppression, may give him diplopia for the rest of his life. Unfortunately, orthoptics are being used inappropriately by many optometrists for expensive, useless treatments of non-existent or incorrectly diagnosed eye conditions. Orthoptics should never be employed without the supervision of an ophthalmologist.

3. *A good cosmetic appearance.*—The cross-eyed child invariably is subjected to psychological trauma at the hands of his playmates who very early in life nickname him "cock-eyed" and make

him realize that he is different and less desirable; his usual response is the development of an inferiority complex, although some will compensate by becoming objectionably aggressive. In later life, the fact that others are embarrassed by his appearance frequently keeps him from being considered for higher positions. Hence, even in cases of intractable amblyopia, or where there is no hope of fusion, surgery on a purely cosmetic basis is advisable for normal psychic development. Many of these individuals, because they lack fusion which, when present, helps to hold the eyes straight, may deviate again, especially during the growth years, and may require further surgery as they grow older in order to maintain a good appearance. The possibility of subsequent surgery should not be used as an excuse for avoiding surgery in the first place.

#### DISCUSSION

The treatment of strabismus has advanced rapidly in the past decade. Ophthalmologists had barely succeeded in persuading their colleagues in the other branches of medicine that the old-fashioned idea of sending children with strabismus to see the oculist before the child went to school was incorrect and that these children should be seen at the age of two years, when they discovered that, to obtain good results, treatment must be begun at six months of age. These rapid changes have led to great confusion both in medical and lay circles, and the present communication is intended to clarify the situation and introduce some degree of consistency into the advice being offered to parents.

#### SUMMARY

All actually or potentially cross-eyed children should be seen by an ophthalmologist when the child is between six and nine months of age.

The ophthalmologist has a three-fold goal in the treatment of strabismus: the establishment of normal vision in each eye, the development of stereoscopic vision, and the provision of cosmetically straight eyes.

#### REFERENCE

1. LEAHEY, B. D.: *Trans. Amer. Ophthal. Soc.*, 58: 106, 1960.

#### PAGES OUT OF THE PAST: FROM THE JOURNAL OF FIFTY YEARS AGO

##### THE GRANDIOSE FORM OF PARESIS

Either depression or exaltation may be the first symptom. These patients always "feel fine" and revel in grandiose ideas of the most senseless and fantastic nature; as illustrated by our patient with his bank of gold, dreadnaughts and other wonderful possessions. A patient of mine in the last stage, helpless and confined to bed, said he could whip Corbett and saw seven cords of wood daily; another stated he had a horse that could trot across the Atlantic in three minutes, and still another was in the habit of giving me million dollar checks when I called. The grandiose ideas are not so marked in women as in men. Paretics are

readily distractible; a little skillful suggestion will turn their morbid fancies in any direction. They are liable to attacks of great excitement, when they are dangerous as wild animals. Hallucinations are not infrequent. The excitation may be tinged with a fringe of depression or hypochondriasis, indeed the clinical picture may for a time assume the typical characteristics of the manic-depressive syndrome. There is a blunting of the moral sense and a loss of all regard for personal appearance. The exaltation may last for years or it may recede, and were it not for the intellectual impairment the patient might be considered practically normal.—C. E. Riggs: *Canad. Med. Ass. J.*, 4: 17, 1914.